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Original Research

Effects of laparoscopic sleeve gastrectomy on early complications and 1-year comorbidity in a single center, single surgeon cohort of 342 patients

Single surgeon LSG experience

Medeni Sermet
Department of General Surgery, Faculty of Medicine, Medeniyet University, Goztepe Prof. Dr. Suleyman Yalcin City Hospital, Istanbul, Turkey

Abstract
Aim: The purpose of this study was to examine the 30-day morbidity and mortality rates after Laparoscopic Sleeve Gastrectomy (LSG) over a 5-year period.
Material and Methods: A retrospective analysis was conducted using prospectively collected data from patients who underwent LSG by the same surgeon between July 2017 and August 2022. The study identified LSG-related 30-day morbidity and mortality rates, as well as risk factors for 30-day morbidity. Furthermore, the impact of comorbidities on patients was evaluated at the 1-year follow-up.
Results: The study analysed the outcomes of 342 patients who underwent laparoscopic sleeve gastrectomy (LSG) over a period of five years. Early postoperative complications were experienced by 11.40% of patients (39 individuals), with six patients requiring blood transfusions, and 2.34% of patients (eight individuals) requiring readmission to hospital. The reoperation rate was 0.87% (three individuals) and the mortality rate was 0.29% (one individual). The study identified body mass index, diabetes, and hypertension as significant factors contributing to early postoperative complications. Technical term abbreviations were defined upon first use. At the six-month follow-up, patients demonstrated an average body weight loss of 62.9 ± 16.17%.
Discussion: The previously reported short-term safety of LSG, in terms of low 30-day postoperative morbidity and mortality rates, was confirmed by this study. Preoperative BMI, diabetes, and hypertension were found to be risk factors for 30-day morbidity and mortality. Additionally, an average 80% improvement in comorbidities was observed at one year.

Keywords
Sleeve Gastrectomy, Early Complications, Single Surgery, Comorbidity

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Corresponding Author: Medeni Sermet, Department of General Surgery, Faculty of Medicine, Medeniyet University, Goztepe Prof. Dr. Suleyman Yalcin City Hospital, Dr. Erkin Street, Kadikoy, Istanbul, Turkey.
E-mail: sermetmedeni@gmail.com P: +90 507 236 70 20
Corresponding Author ORCID ID: https://orcid.org/0000-0001-6119-0037
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Introduction

Obesity has been recognized as a widespread problem that is considered a public health crisis, due to the significant negative impact it has on one's health [1]. Obesity surgery has proven to be a successful solution for patients who have not been able to achieve weight loss through non-surgical methods, and has shown to improve comorbidities related to obesity [2, 3]. This surgical intervention can be considered an important tool in the fight against obesity, and may be a vital treatment option for patients.

Laparoscopic sleeve gastrectomy (LSG) is a bariatric procedure that is rapidly increasing in popularity owing to its simple technical structure, safety and efficacy [4]. Based on a report by IFSO (International Society for the Surgery of Obesity) in 2018, this surgical procedure has been the most widely performed bariatric surgery since 2014 [5]. This can be considered a significant development in the treatment of obesity, and has become the preferred option for many patients for weight loss and health improvement.

Like any surgical intervention, LSG can be complicated by adverse events and involves risks that can result in death. The 30-day morbidity and mortality rates are important measures of the safety of surgical procedures and have been used for many years [6,7].

The aim of this study was to identify 30-day morbidity and mortality risk factors for LSG and to contribute to the development of strategies for perioperative management of patients undergoing this procedure. Focusing especially on at-risk groups may contribute to a safer implementation of LSG and help reduce adverse outcomes. This allows for the development of more effective and safe practices in the field of bariatric surgery.

Material and Methods

This study is based on data collected retrospectively from a consecutive group of patients who underwent LSG performed by a single surgeon over a 5-year duration. This study was approved by the Ethics Committee of Medeniyet University (Date: 22.07.2022 – No: 259).

The inclusion criteria were as follows: Patients aged 18-65 years, BMI = 35 - 39.90 kg/m2 with at least one obesity-related chronic comorbidity, and BMI > 40 kg/m2.

Exclusion criteria: Patients admitted for revisional bariatric surgery and those who opted for other bariatric surgical procedures, concurrent cholecystectomy, or herniation surgery were excluded. Furthermore, patients without follow-up data in the hospital registry system were excluded from the study.

Patients underwent a routine preoperative workup, including personal history taking, multidisciplinary clinical evaluation, laboratory investigations, and upper gastrointestinal endoscopy. A total of 72 patients were excluded based on the exclusion criteria.

Surgical Procedure

All patients underwent surgery according to the ERABS protocol [8]. After the usual preoperative preparations, the surgery was carried out under general anaesthesia. Pneumoperitoneum was induced, and a sleeve was inserted through a 38 Fr spark plug with resection taking place about 3-4 cm proximal to the pylorus. Subsequently, customary postoperative care was administered, and patients were advised to mobilise early and given a postoperative dietary regime, supplement plan, and schedule of follow-up visits. Patients were also informed to seek medical attention in the event of any adverse reaction.

Demographic characteristics, operative details, and perioperative events were recorded and analyzed.

Thirty-day postoperative data was available for all patients while excluding one case of death, resulting in 341/342 patients (99.7%) having available 6-month follow-up data. Moreover, data for 338 patients (98.8%) were accessible at the 1-year follow-up..

Statistical Analysis

Patient data were analyzed using the Statistical Package for Social Sciences (SPSS) software (IBM Corp., Armonk, NY, USA), version 28. Numerical data were presented using mean, standard deviation, and range, while frequencies and percentages were used for categorical values. To identify early postoperative morbidity risk factors, a binary logistic regression analysis was conducted, with statistical significance set at 0.05.

Results

This investigation comprised 342 individuals who received LSG carried out by a single surgeon from July 2017 to August 2022. The average age of the patients was 37.89 ± 11.36 years, with a higher prevalence among women (82.74%, n = 283). The preoperative weight ranged from 96 to 192 kg, with a mean of 126.93 ± 23.32, and preoperative BMI ranged from 37.7 to 69.2 kg/m2. On average, the body mass index (BMI) of patients was 45.3 ± 8.06 kg/m2 and the excess body weight (EBW) before surgery ranged from 38.3 to 122.1 kg with a mean of 62.1 ± 4.64 kg. The patients had accompanying diseases, such as dyslipidemia, hypertension, type 2 diabetes, and obstructive sleep apnea (Table 1).

The preoperative prophylaxis against deep vein thrombosis (DVT) was given subcutaneously as Enoxaparin (0.4 mL). Two weeks of anticoagulant therapy for DVT prophylaxis was continued. Table 2 shows the distribution of complications.

The total surgical duration ranged from 34 to 96 minutes, with an average of 52.18 ± 25.22. Early postoperative side effects

Table 1. Patients demographic and clinical characteristic features

Parameters	Study patients N=342 (Mean±SD)	Range
Female (years)	283 (82.7%)	18 – 64
MaleYears)	59 (17.3%)	21 - 61
Age (years)	37.89 ± 11.36	18 - 64
Weight (kg)	126.26 ± 26.32	96 -192
BMI (kg/cm2)	45.3 ± 8.06	37.7 – 69.2
EBW (kg)	62.1 ± 4.64	38.3 – 122.1
Obesity-related comorbidity		
OSAS	19 (5.5%)	
T2D	123 (35.9%)	
Hypertension	89 (26.0%)	
Dyslipidemia	87 (25.4%)	

BMI: Body mass ındex, OSAS: Obstructive Sleep Apnea Syndrome; T2D: Type 2 Diabetes
EBW: Excess body weight

Table 2. Distribution of complications

Parameters	Study patients N=342 (Mean±SD)	Range
Total surgery time (minutes)	52.4 ± 17.56	34-96
Hospital stay (days)	2.21 ± 1.34	2.16
Drain insertion	342	
Complications		
İntraoperative Hemorrhage	4 (1.17 %)	
Postoperative Hemorrhage	10 (2.91 %)	
Trocar site hernia	3 (0.87 %)	
Fistula	3 (0.87 %)	
Trocar site haematoma	3 (0.87 %)	
Stapling issue	2 (0.58 %)	
İntra-abdominal collection	2 (0.58 %)	
Twisting	1 (0.17 %)	
Portal vein thrombosis	1 (0.17 %)	
Dehydration	8 (2.34 %)	
Staff inattention	2 (0.58 %)	
Applications		
Transfusion	6 (1.75 %)	
Re-operation	3 (0.87 %)	
Mortality	1 (0.17 %)	
Re-hospitalization	8 (2.34 %)	
Local intervention	3 (0.87 %)	

Table 3. Binary logistic regression analysis for complication risk

Parameters	Binary logistic regression analysis (N=342) OR (95% Confidence Interval)	p values
Age (years)	1.12 (1.01-1.24)	0.643
Gender (Female/Male)	0.97 (0.85-1.03)	0.872
BMI (kg/cm2)	1.72 (1.63-1.81)	<0.001
EBW (kg)	1.38 (1.30-1.47)	<0.001
OSAS	0.92 (0.89-1.01)	0.648
T2D	1.63 (1.41-1.79)	<0.001
Hypertension	1.49 (1.34-1.57)	<0.001
Dyslipidemia	0.82 (0.76-0.85)	0.322

were observed in 39 (11.42 %) patients. Complications occurred in 25 patients before discharge and in 14 within the first 30 days after discharge. The total hospital stay varied from 2 to 16 days.

Ten patients had intra-abdominal hemorrhage in the postoperative period, which developed within the first 24 h. Four patients were treated conservatively, while six patients with hemodynamic instability were treated with erythrocyte suspension.

Hematoma was present at the trocar site in three patients, two at the 10 mm port site, and one at the 15 mm port site, and the patients were treated with local drainage by suturing.

Postoperative leakage developed in three patients, with one occuring within the first 24 hours and the other two within 48 hours. These three patients typically developed leakage at the His angle and were treated primarily through open laparotomy. Two patients experienced an intraoperative leakage. In both patients, the nasogastric catheter was found in the stapler line, and intraoperative primary repair was performed. Intraoperative hemorrhage was observed in four patients, which was due to gastrolienal ligament dissection in two patients, splenic capsule rupture in one patient, and retractor entry due to left liver injury. Three patients had intra-abdominal abscesses complicated with hematoma formation and were treated with percutaneous abscess drainage under the umbrella of antibiotic therapy. Three patients had hematoma at the trocar site, one patient developed hematoma after coughing at the 10 mm port site, and the other two hematomas developed after intraoperative inadequate drainage at the 15 mm port site. All three patients were treated with local hematoma drainage by suturing.

A 36-year-old woman with a BMI of 53.1 kg/m2, type 2 diabetes (T2D), hypertension and dyslipidemia developed portal vein thrombosis on day 20. She underwent thrombolysis under radiological monitoring, followed by continuous thromboprophylaxis. A 52-year-old male patient with a BMI of 62.5 kg/m2, T2D, and hypertension developed bleeding in the first 24 hours postoperatively and was administered a total of 3 units of erythrocyte suspension. However, pulmonary embolism developed on the 14th postoperative day despite thromboprophylaxis in the patient who had inadequate mobilization afterwards, and the patient was transferred to the intensive care unit.

During one year of regular ultrasonography follow-up, herniation developed at the trocar entry site in 3 cases. Two of the herniations were at the 15 mm port site, and one was at the 10 mm port site. Richter's hernia developed at the 10 mm port site on the left upper part of the umbilicus on the 8th day and small bowel resection and anastomosis was performed at 120 cm because the jejunum anus was necrotic. Another patient had volvulus in the incisura angularis due to persistent vomiting on postoperative day 20, which was resolved with gastric bypass.

Factors contributing to early postoperative adverse events are shown in Table 3.

Binary logistic regression analysis showed that BMI (OR = 1.078, CI 0.962 – 1.2, p = 0.048), T2D (OR = 0.88, CI 0.762 – 0.952, p = 0.037), hypertension (OR = 0.091, CI 0.021 – 0.469, p = 0.003), and reoperation (OR = 0.55, CI 0.137 – 0.982, p = 0.058) were significant predictors of early postoperative morbidity.

At 6 months follow-up, the mean BMI was 35.82 ± 5.69 kg/m2. The mean EBWL% was 62.9 ± 16.17%. The mean BMI was 28.92 ± 5.32 kg/m2, and the mean EBWL% was 81.57 ± 16.15% at 1 year post-op. Considering associated comorbidities, 96.05% of patients with dyslipidemia (n=84), 72.31% of patients with hypertension (n=89), 89.12% of patients with diabetes (n=82), and 100% of patients with obstructive sleep apnea (n=19) had complete recovery.

Discussion

This retrospective cohort study was conducted to evaluate the safety and efficacy of bariatric surgery, particularly LSG. These findings suggest that bariatric surgery is an important treatment option for obese patients. In this retrospective cohort study of 342 patients who underwent LSG by a single surgeon in our center, the early postoperative morbidity, reoperation, local intervention, rehospitalization, and mortality rates were 11.40%, 0.87%, 0.87%, 0.87%, 2.34%, and 0.29%, respectively. Despite the reported safety of bariatric surgery, varying rates of perioperative complications have also been reported. Patients

undergoing bariatric surgery are at high risk of developing early postoperative complications. Therefore, it is important to identify the risk factors for early postoperative complications to optimize pre- and post-operative care. In the literature, 30-day complication rates after bariatric surgery range from 0.2% to 5%, and reoperation rates range from 0.6% to 1.1% [9, 10]. Mortality rates were found to be between 0 and 0.3% [11]. Although our total complication rate in the first 30 days seems to be high, this may be because we included data such as local drainage, intraoperative hemorrhage, and dehydration, which do not prolong the patient's hospitalization period. Furthermore, mortality and reoperation are consistent with the literature. These data were collected in order to expand the scope of our study and provide a more thorough evaluation. Additionally, including this data allows for a more comprehensive assessment of the success of surgical interventions, rather than solely focusing on severe complications. Timely diagnosis and management of adverse events that may occur during the 30-day postoperative follow-up directly affect the success of surgery. The mortality rate was 0.13% in a database of 3.6 million cases [12]. In the present study, the single-case mortality rate was 0.29%. This finding is consistent with the general literature. These results emphasize the relative safety of bariatric surgery and reflect the advances in minimizing the risks associated with this procedure.

In our study, the patient's BMI, presence of hypertension, and diabetes were found to be predictors of early perioperative morbidity. A greater risk of disease has been documented in patients with a BMI of 40.0 or higher, particularly when they have both hypertension and diabetes. The risk of disease in this group is 15% [12, 13]. These results suggest that a patient's preoperative status and metabolic syndrome have a significant impact on the risk of complications after bariatric surgery. Furthermore, it has been observed that patients with a higher BMI have an increased rate of leakage, and hypertension is associated with an increased risk of early bleeding [13].

In addition to these risk factors, the learning curve for specialized surgery also affects early complications. In a survey conducted in Italy, 54.3% of bariatric surgeons stated that they had never received bariatric surgery training during their specialty training [14]. When we assigned our study patients to three consecutive equal groups, 19 (48.7%) complications were observed in the first 100 cases, and serious complications, such as fistula and bleeding, were observed in this period. On the other hand, forgetting to withdraw the orogastric catheter, which seems to be a preventable complication, was also observed in the first 100 cases. It is possible that many surgeons have learned the principles of surgery through courses and short training sessions. This finding suggests that complications may occur more frequently during learning.

The rates of comorbidities in the first 6 months and the first year after LSG in our patients were comparable to those previously reported [15,16]. The rates of improvement in dyslipidemia, hypertension, and T2DM at 6 months and 1 year were > 80%. In a previous study, dyslipidemia and hypertriglyceridemia improved by 45% and 86%, respectively [17].

Unlike the literature, we found that all of our patients with apnea syndrome (all 19 cases) had resolution of their complaints and were device-free [18, 19]. We believe that this high rate is due to the low number of patients with apnea syndrome in our cohort and the fact that we evaluated the patients' drug and device use rather than postoperative measured data.

The postoperative bleeding rate after LSG has been reported to vary between 2-4% [20, 21]. The rate in our study was 2.9%. Although these rates are similar to those reported in the literature, it is worth noting that we still found them high. We did not apply any reinforcement to the stapler line in ⅔ of the cases. Later, with increasing experience, we observationally decreased the bleeding rates by selecting patients with bleeding risk, using postoperative tranexamic acid, and, in some cases, using reinforcing sutures on the stapler line. However, we did not transfuse blood products in patients who developed bleeding unless vital signs significantly deteriorated. Adequate fluid resuscitation and blood product supplementation when necessary for the diagnosis of bleeding can solve these problems. Reoperation should be avoided, whenever possible because possible complications of the new operation may cause more difficult and longer treatment processes [22].

Leakage is an important and frightening complication. Most leaks occur in the first week and reported rates are between 0.5-5% [23, 24].

Our results were consistent with those reported in the literature. Based on our experience, the leak rate decreases with increasing experience and follow-up. All our leakage cases were within the first 20 consecutive cases. Although endoscopic stenting for leaks is prioritized in the literature, we performed early laparotomy and primary repair because of individual concerns. In the following cases, applying clips to the stapler joints, paying particular attention to the His angle, and applying clips to the last point in the fundus region were found to be very effective in preventing leaks.

During one year of regular ultrasonography follow-up, three patients developed herniation at the trocar entry site. Two of these herniations occurred at the 15 mm port entry, and the other at the 10 mm port entry. Trocar site herniation occurs in 0.1-2% [24]. Richter's hernia developed on the 8th day especially at the 10 mm port entry in the upper left region of the umbilicus and small bowel resection and anastomosis were required because the jejunum anus was necrotic. Another patient was diagnosed with volvulus in the incisura angularis on postoperative day 20 because of persistent vomiting and underwent gastric bypass surgery. During the surgical operation, regardless of surgical experience, in two patients, the orogastric catheter was forgotten before stapling, and the catheter remained in the stapler line. Fortunately, this error was quickly recognized, and a primary repair was performed. This highlights the importance of synchronization within the surgical team. It should also be kept in mind that due to staff turnover, every step should be checked, and the staff should be careful, even though it may seem like a continuous routine.

The most common reason for readmission in our patient group was dehydration [25]. This occurs because of patients' fear after LSG and difficulty in adapting to their new lifestyle. In this case, patients should be hospitalized before their vital signs worsen, appropriate nutrition should be provided, and vitamin and electrolyte disorders should be corrected.

Based on the results of our study, we confirmed that LSG is an effective method for weight loss and the improvement of obesity-related comorbidities. The first 30-day complication rates are consistent with those in the current literature, and the success rate has increased in proportion to timely complication management and increasing experience.

Limitations: The study was limited to a single center with a single surgeon and a relatively small number of cases. The advantages are that it included all cases in the learning curve and experience gaining phase and that the records and treatments were recorded in detail from a single source.

In conclusion, this study shows that bariatric surgery is a safe and effective treatment option for obese patients. Preoperative review can be an important tool for surgeons to identify risk factors. Although undesirable, encountering and managing a range of complications within limits have contributed to lower complication rates by making subsequent surgeries more careful and safer. However, while more research is needed, keeping records without omitting minor details will help us better understand the long-term effectiveness of bariatric surgery and the risk of complications.

In summary, this study affirms that the Laparoscopic Sleeve Gastrectomy (LSG) procedure is linked with minimal complications during the 30-day postoperative period. These findings highlight the potential for LSG as a dependable and advantageous alternative for addressing obesity in clinical settings. Specifically, the low incidence of complications may assist patients in recovering postoperatively and provide health practitioners with a secure surgical choice. Additionally, the results indicate that patients with other obesity-related health issues, such as type 2 diabetes or hypertension, have a reduced risk of postoperative complications. This information could serve as a significant source of guidance for patients contemplating this procedure. The findings of this research can enhance the approach to managing obesity and its related comorbidities, thus enabling healthcare professionals to make more informed choices.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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